

## New Species and New Combinations of Grammitidaceae from Peru

BLANCA LEÓN

Plant Resources Center, Herbarium,  
University of Texas at Austin, Bio Labs 311,  
Austin, TX 78712, U.S.A.  
and Museo de Historia Natural,  
Av. Arenales 1256, Apartado 14–0434, Lima–14, Peru

ALAN R. SMITH

University Herbarium, 1001 Valley Life Sciences Bldg. #2465  
University of California, Berkeley, CA 94720

ABSTRACT.—We describe two new species from Peru, *Ceradenia tryonorum* and *Terpsichore youngii* (Grammitidaceae). *Ceradenia tryonorum* is a member of subg. *Ceradenia* and is unusual in having hydathodes. *Terpsichore youngii* belongs to the *T. taxifolia* group. Three new combinations are made: *Melpomene youngii*, *Terpsichore anfractuosa*, and *T. subscabra*. We provide a key for the nine species of the *T. taxifolia* group in Peru.

Tryon and Stolze (1989–1994) documented almost 1060 species of pteridophytes in Peru; their work greatly facilitates the recognition of new species and new distributional records. Recent botanical explorations in Peru provide interesting fern additions for this rich tropical flora.

In the Neotropics, the Grammitidaceae are represented by nine genera: *Ceradenia*, *Cochlidium*, *Enterosora*, *Grammitis*, *Lellingeria*, *Melpomene*, *Micropolypodium*, *Terpsichore*, and *Zygophlebia*. The Peruvian fern flora includes 67 species in these genera (Tryon & Stolze, 1993), with probably another dozen species expected based on recent accounts from neighboring countries (Jørgensen & León-Yáñez, 1999; Smith et al., 1999). Here we describe two new species, one in *Ceradenia* and the other in *Terpsichore*.

### *Ceradenia tryonorum* B. León & A. R. Sm., *sp. nov.* (Fig. 1 A–D)

TYPE: Peru. San Martín: Province Mariscal Cáceres, Parque Nacional Río Abiseo, near El Tingo, 7°58'S, 77°18'W, 2800 m, 29 June 1999, B. León & K. R. Young 3840 (holotype: USM!; isotypes: TEX!, UC!).

Rhizomata breve repentia, radialia; paleae densae, stramineae, lanceolatae ca. 4–7 × 1–1.5 mm, non clathratae, apice obtusae vel apiculatae, setiferae. Frondes 10–15 cm longae. Petioli straminei, phyllopodiiis instructi. Laminae pinnatifidae, oblongae, pilis furcatis et pilis glandulosis conspersis vestitis; venae simplices vel interdum furcatae, liberae, adaxialiter in hydathodis terminantes. Sori lineares, superficiales, 3–6 (–10) mm longi.

Rhizomes suberect, radially symmetrical, 5 mm thick, densely covered with overlapping, stramineous to light tan, non-clathrate scales, rhizome scales



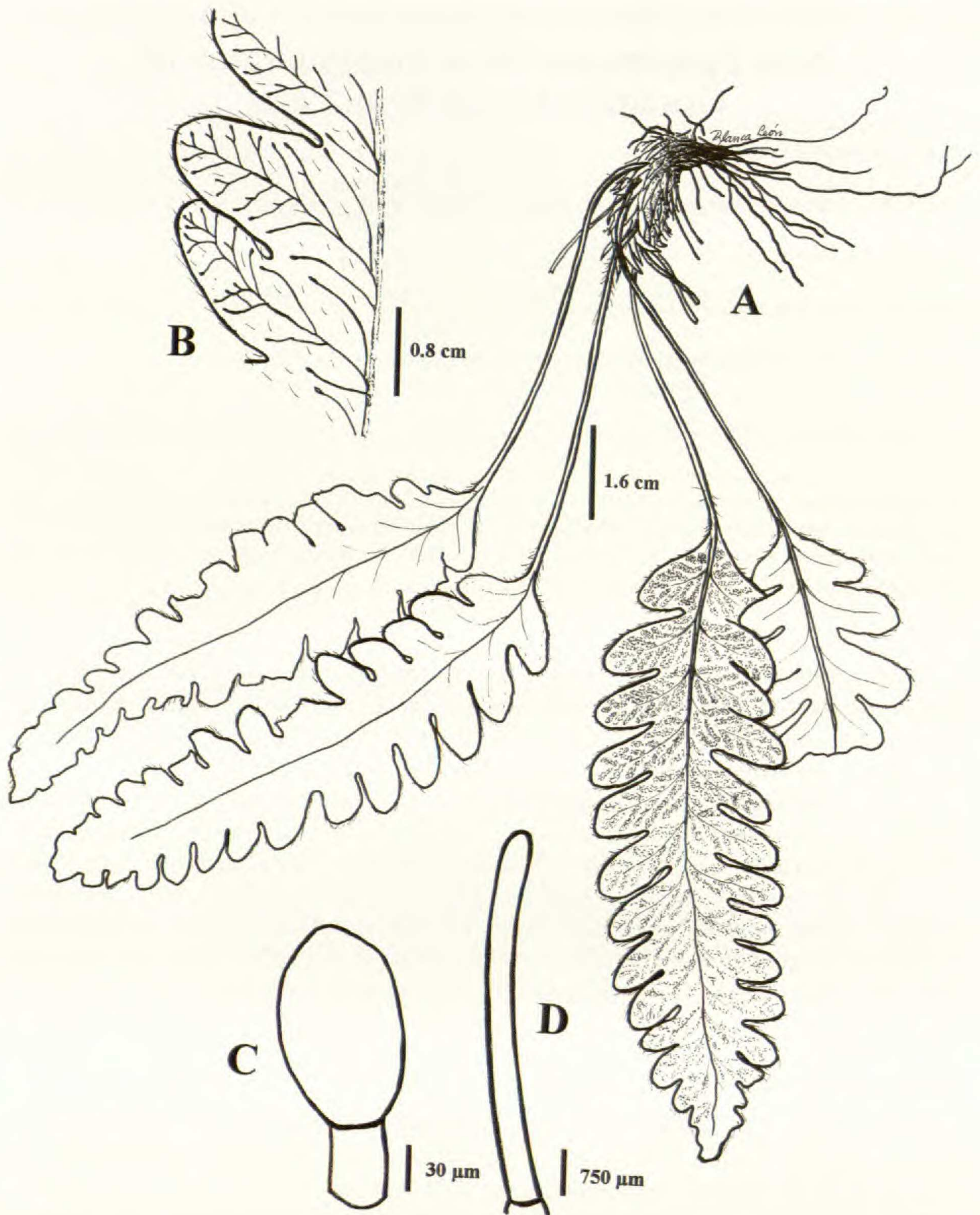


FIG. 1. *Ceradenia tryonorum* (León & Young 3840, USM). A) Fronds. B) Adaxial portion of central lamina showing venation and scattered setae. C) Glandular hair from the abaxial surface of the lamina. D) Seta from abaxial surface of the lamina.



4–7 mm × 1–1.5 mm, lanceolate, apices apiculate or obtuse, apical portion with a glandular furcate hair, branches of hair similar in length or one three times more elongated, margins entire or rarely with furcate hairs. Leaves pendant, 10–15 cm long, petiolate; petioles tan to light brown, dull, 2.7–7 cm × 0.4–0.85 mm, articulate, covered with abundant simple to often furcate hairs 0.1 mm long, also with scattered dark brown setae 1–3 mm long, at the base with inconspicuous, black phyllopodia, 0.5–1 mm long. Laminae thin, with spongy parenchyma, 6.5–10 cm × 2–3.5 cm, narrowly ovate, pinnatifid, incised about halfway to rachis, proximal segments not or slightly reduced, laminae bases shortly cuneate, lamina apices acute, segments ascending (55–) 60–75°, 1–1.5 × 0.5–0.7 cm, segment apices obtuse, costae hidden or slightly prominent abaxially, prominulous and of the same color as the lamina adaxially; abundant red-brown setae on both surfaces, setae mostly 1–2 mm long, lamina abaxially with abundant wax-like glandular hairs, adaxially with scattered furcate glandular hairs; veins free, pinnate, 5–8 pairs of veins per segment, ultimate veinlets simple or furcate, basal veins borne from the rachis at the middle of the lamina, veins ending in hydathodes adaxially, these 0.1–0.2 mm long, without calcareous deposits; sori superficial, linear, 3–6 (–10) mm long, extending from costae to margins of segments; sporangia 200–350 × 120–142 µm, with 11–14 annulus cells; spores 25 µm diam.

*Distribution and habitat.*—This species is known only from the type locality in northeastern Peru. It grows as an epiphyte in montane forests. The understory included *Chusquea scandens* Kunth, with about 40% cover. Stature of canopy dominants was often 11–13 m, with emergents to 15 m. Common medium and large trees included *Brunellia*, *Clethra*, *Freziera*, *Hedyosmum*, *Symplocos*, and *Weinmannia*, among others.

The species epithet honors Drs. Alice F. Tryon and the late Rolla M. Tryon for their contributions to our knowledge of the Peruvian pteridoflora.

*Ceradenia tryonorum* is characterized by stramineous to light tan rhizome scales, radially arranged leaves, 2.7–7 cm long petioles, pinnatifid laminae, minute wax-like glandular hairs on the abaxial surface of the laminae, adaxial hydathodes, and linear non-sunken sori. In fresh material, the costae are obscure adaxially, but abaxially they are conspicuous in the proximal portion of the leaf.

This species has the wax-like glands characteristic of *Ceradenia*, a genus of approximately 55, mostly neotropical, species (one in Africa and perhaps a few in Madagascar). The glands are a synapomorphy of the genus, and clearly establish the affinities of *C. tryonorum*. However, a combination of characters makes it difficult to establish clearly the intrageneric affinities and subgeneric position of *C. tryonorum*. Rhizome morphology and anatomy, together with laminar indument, were the main characters used to circumscribe two subgenera in *Ceradenia* (Bishop 1988). Species in subg. *Filicipecten* have dorsiventral and solenostelic rhizomes, lack wax-like laminar glands, and have petiolate laminae, while subg. *Ceradenia* has radially symmetrical and dictyostelic rhizomes, wax-like glandular laminar trichomes, and short-petiolate or sessile laminae. Species of both subgenera have round or oblong sori, the usual



condition in Grammitidaceae. In the totality of its characters, we believe that *Ceradenia tryonorum* is a member of subg. *Ceradenia*, but a very atypical one, especially because of the linear sori, and distinct petioles.

*Ceradenia* (Bishop 1988), *Enterosora* (Bishop & Smith 1992), and *Zygo-phlebia* (Bishop 1989) include exclusively anhydathodous neotropical and a few African-Madagascan species. The anhydathodous condition and the presence of a spongy leaf parenchyma indicate a close relationship among these three genera. *Ceradenia* and *Enterosora* include species with entire to shallowly pinnatifid to pinnatisect laminae and mostly free veins, whereas *Zygo-phlebia* has anastomosing veins and usually more deeply dissected blades. Until now, only one exception to the anhydathodous condition was known in this closely related assemblage: *Enterosora asplenioides* L. E. Bishop, from Ecuador and Colombia. The hydathodous condition in *C. tryonorum* is similar to that found in *E. asplenioides*, which has thin spongy laminae and superficial sori. The shared presence of hydathodes and the linear sori in these two species may reflect deeper relationships between *Ceradenia* and *Enterosora*. Bishop (1989), however, interpreted the absence of hydathodes as an ancestral state within the Grammitidaceae. These recently found exceptions may help to understand the evolution of these mostly upper montane genera.

***Terpsichore youngii* B. León & A. R. Sm., *sp. nov.* (Fig. 2 A–B)**

Type: Peru. Cusco: near San Lorenzo, 2300–2500 m, 6 July 2000, *B. León & K. R. Young 4487* (holotype: USM!; isotype: UC!).

Rhizomata breve repentia, 2–3 mm diam.; paleae densae, clathratae, margine setis hyalinis ornatae. Frondes 10–25 cm longae. Petioli brunnei. Laminae pinnatisectae vel pectinatae, anguste lanceolatae, pinnis 25–40 jugis pinnarum, abaxialiter dense pilosis; venae simplices, liberae, adaxialiter in hydathodis non calcareas terminantes.

Pendant epiphytes. Rhizomes short-creeping, 2–3 mm wide, densely scaly; rhizome scales clathrate, 0.8–1.5 mm × 0.15–0.3 mm, lanceate, apical and marginal hyaline setae present, setae 0.07–0.13 mm long. Leaves 10–25 cm long, petiolate, petioles 3–7 cm × 0.2–0.7 mm, dark brown, dull, hairs 0.5–1.5 mm long; laminae chartaceous, narrowly lanceolate, gradually reduced at both ends, 1–4 cm wide, pinnatisect or pectinate, with 25–40 pairs of pinnae, these ascending 60–75° from rachis, 1–5 proximal pinnae less than half the total length of the longest pinna, gradually reduced to small segments, pinnae linear 1–2 cm × 1–2.5 mm, acute, pinna bases nearly symmetrical, abaxially with numerous red-brown hairs, 0.3–1 mm long (similar to those on the rachis), adaxially glabrous, pinna margins entire or with a few scattered glandular hairs; rachises densely hirsute, hairs 0.5–1 mm long, red-brown, also with scattered, black club-shaped fungi abaxially; veins free, central pinnae with 5–12 pairs of simple veins, adaxially ending in hydathodes lacking calcareous deposits; sori medial, oblong, sporangia without setae.



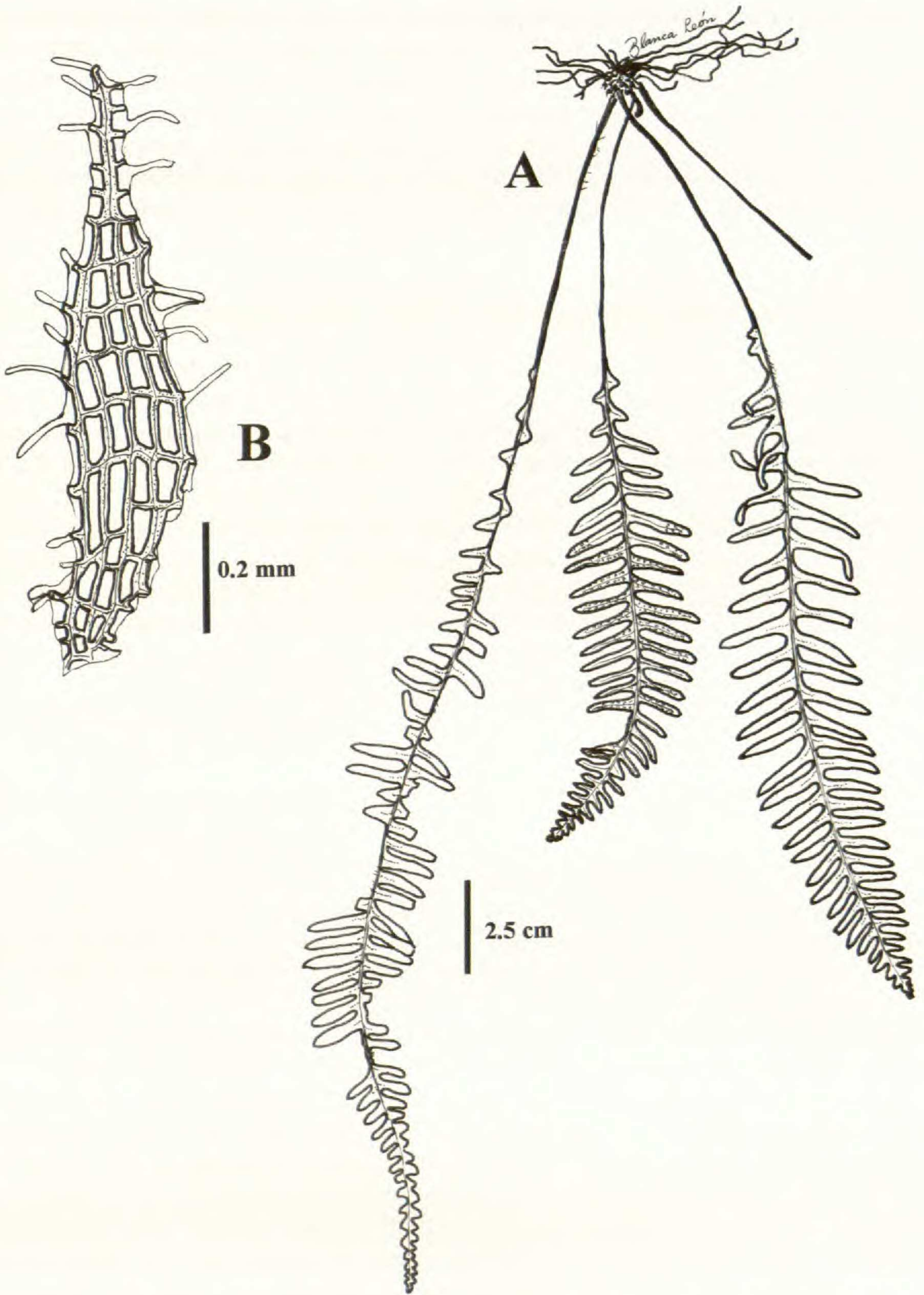


FIG. 2. *Terpsichore youngii* (León & Young 4487, USM). A) Fronds. B) Rhizome scale.



*Distribution and habitat.*—This species is known from Peru and Bolivia. It grows in forests dominated by *Weinmannia*, *Clusia*, *Symplocos*, *Brunellia*, *Miconia*, *Myrsine*, and Lauraceae, between 2200–3000 m elevation. The epithet honors Kenneth R. Young for his scientific endeavors in Peru.

*Collections examined.*—Bolivia. Cochabamba: Province Ayopaya, 10 km Cocapata-Cotacajes, 16°38'S, 66°41' W, 3000 m, 9 May 1997, *Kessler et al. 9401* (LPB not seen, UC); Cochabamba: Province José Carrasco Torrico, 5 km de Siberia a Karahuasi, 17°48'S, 64°41'W, 2200 m, *Kessler et al. 9059* (LPB not seen, UC).

This species belongs to the *Terpsichore taxifolia* group (Group 2 of Smith, 1993), which is characterized by the presence of club-shaped black fungi of the genus *Acrospermum*. Possibly, *T. youngii* is most closely related to *T. alsopteris* (C. V. Morton) A. R. Sm. Both species have chartaceous, pectinate laminae, with a few reduced proximal pinnae, and hairs on the laminae between veins abaxially. *Terpsichore youngii* differs from *T. alsopteris* (C. V. Morton) A. R. Sm. in having strongly clathrate rhizome scales and non-calcareous hydathodes. *Terpsichore youngii* has also considerably longer hairs on the lamina abaxially. In addition, the hairs on the rachises and laminae in *T. alsopteris* are less dense. A closer relationship of *T. youngii* is probably with *T. david-smithii* (Stolze) A. R. Sm. from Peru and Bolivia. That species agrees with *T. youngii* in having clathrate scales; however, the setae on the scales of *T. david-smithii* are darker, less numerous, and stiffer.

***Terpsichore anfractuosa* (Kunze ex Klotzsch) B. León & A. R. Sm., comb. nov.**

*Polypodium anfractuosum* Kunze ex Klotzsch, *Linnaea* 20:375. 1847.  
*Grammitis anfractuosa* (Kunze ex Klotzsch) Proctor, *Rhodora* 63:35. 1961.  
*Melpomene anfractuosa* (Kunze ex Klotzsch) A. R. Sm. & R. C. Moran, *Novon* 2:429. 1992.—Type: Venezuela. Mérida: *Moritz 330* (holotype B, photo F; isotypes B, US!).

*Distribution and habitat.*—Antilles, s. Mexico, Central America, Colombia, Venezuela, Guyana, Ecuador, Peru, Bolivia; epiphytic in cloud forests.

Recent molecular work by Ranker *et al.* (unpubl.) indicates that this species, with black clavate fungi of the genus *Acrospermum*, groups with *Terpsichore pichincae* (Sodirol) A. R. Sm., and hence belongs in Group 2 of that genus (Smith, 1993). This result might have been predicted simply by the presence of the distinctive black fungus on the abaxial rachis, costae, and sometimes within the sori. The presence of this fungus is a synapomorphy of *Terpsichore*, Groups 2 and 4, and we are unaware of the presence of this peculiar and distinctive fungus in any other grammitids, or any other fern, for that matter. *Terpsichore anfractuosa*, a rather strongly divergent and distinctive species itself, was placed in *Melpomene* by Smith and Moran (1992) because of the small, clathrate, entire rhizome scales. These scales are evidently very reduced in this species (and hence difficult to interpret), however, in a few specimens



rhizome scales have marginal setae at and near the apex. Some species of *Terpsichore* also have clathrate scales (e.g., *T. david-smithii*, *T. pichinchensis*). *Terpsichore anfractuosa* is distinguished from other species in *Terpsichore* (and *Melpomene*) by root proliferations ("stoloniform roots"; Tryon & Stolze, 1993:99–100) that produce buds and new plants (leading to a colonial habit on trunks and branches of trees), small fronds, and narrowly elliptical laminae (tapering gradually, at the base).

KEY TO *TERPSICHORE TAXIFOLIA* GROUP IN PERU

1. Laminae pinnate-pinnatifid, if only pinnate then pinna margins strongly crenate. . . . .  
 . . . . . *T. athyrioides* (Hook.) A. R. Sm.
1. Laminae pinnatisect to pinnate. Pinna margins entire.
  2. Rhizome scales 0.3–1 mm long, clathrate; proliferous roots present.
    3. Lamina setae < 1 mm long. Sori with setae. Rhizome scales less than 1 mm long, with entire margins . . . . . *T. anfractuosa* (Kunze ex Klotzsch) B. León & A. R. Sm.
    3. Laminae setae  $\geq$  1 mm long. Sori without setae. Rhizome scales with marginal setae . . . . . *T. pichinchensis* (Hieron.) A. R. Sm.
  2. Rhizome scales > 1 mm long, clathrate or not; proliferous roots absent.
    4. Rhizomes scales clathrate.
      5. Rhizome scales with rigid marginal setae; laminae 2–5 cm wide . . . . .  
 . . . . . *T. david-smithii* (Stolze) A. R. Sm.
      5. Rhizome scales with hyaline marginal and apical setae; laminae 1–4 cm wide . . .  
 . . . . . *T. youngii* B. León & A. R. Sm.
    4. Rhizome scales non-clathrate.
      6. Rhizome scales with entire margins; laminae without lime dots adaxially. . . . .  
 . . . . . *T. taxifolia* (L.) A. R. Sm.
      6. Rhizome scales with marginal setae; laminae usually with lime dots adaxially.
        7. Marginal setae hyaline . . . . . *T. alsopteris* (C. V. Morton) A. R. Sm.
        7. Marginal setae dark colored and rigid.
          8. Leaves < 2 cm wide, with setae abaxially and along margins; veins fewer than 5 pairs per pinna . . . . . *T. pichinchensis* (Hieron.) A. R. Sm.
          8. Leaves > 3 cm wide; glabrous or very sparsely setose abaxially; veins more than 6 pairs per pinna.
            9. Leaves 2.5–4 cm wide; veins 6–13 pairs per pinna. . . . .  
 . . . . . *T. leucosticta* (J. Sm.) A. R. Sm.
            9. Leaves 3.5–8 cm wide; veins 16–24 pairs per pinna . . . . .  
 . . . . . *T. semihirsuta* (Klotzsch) A. R. Sm.

***Terpsichore subscabra* (Klotzsch) B. León & A. R. Sm., comb. nov.**

*Polypodium subscabrum* Klotzsch, *Linnaea* 20:377. 1847. *Grammitis subscabra* (Klotzsch) C. V. Morton, *Phytologia* 22:80. 1971.—Type: Venezuela. Mérida, *Moritz* 332, (holotype B; isotypes BM-photos F!, K!, TEX-LL!).

*Polypodium jamesonioides* Fée, *Mém. foug.* 7:59, t. 21, f. 4. 1857. *Grammitis jamesonioides* (Fée) C. V. Morton, *Contr. U.S. Natl. Herb.* 38:108. 1967. *Terpsichore jamesonioides* (Fée) A. R. Sm., *Novon* 3: 487. 1993.—Type: Colombia. Santander, Ocaña, *Schlim* 399 (holotype L; photos F, UC!, US).



*Distribution and habitat.*—Hispaniola, Costa Rica, Panama, Colombia, w. Venezuela, Ecuador, Peru; epiphytic or epipetric, pendant, in paramos and subparamos, dwarf forests.

*Terpsichore subscabrum* was misinterpreted by Stolze (1991) as a *Polypodium*, thus contradicting Morton's (1971: 80) placement of the species in *Grammitis*. Stolze excluded *P. subscabrum* from *Grammitis s.l.* and also from *Pecluma*, and characterized the taxon as having "Petiole subglabrous, with swollen articulation at base. Lamina pectinate, 22 cm long and 1.7 cm broad, axes and tissue scabrous, viscid, trichomes 0.1 mm long, tightly appressed; pinnae to 0.8 cm long, 0.2 cm broad, linear, subacute; spores yellow, monolete." Our examination of the type, however, shows that it clearly belongs to *Terpsichore*, and not to *Polypodium*, where Stolze placed it. Within *Terpsichore*, it belongs to the group of *T. lanigera* (Group 3 of Smith, 1993). This group of *Terpsichore* often has monolete spores (Wagner, 1985; Smith, 1993), and some species, particularly *T. subscabra*, have viscid, appressed glands, an unusual character in grammitids.

***Melpomene youngii* (Stolze) B. León & A. R. Sm., *comb. nov.***

*Grammitis youngii* Stolze, Fieldiana, Bot. 32:97. 1993.—TYPE: Peru. San Martín, Province Mariscal Cáceres, Parque Nacional Río Abiseo, Puerta del Monte, 3600 m, 19 Nov 1985, K. R. Young 1684 (holotype: USM!; isotype: F).

*Distribution and habitat.*—Peru and Bolivia. This epiphytic species with pendant leaves is commonly found in upper montane forests.

It appears to be related to *Melpomene sodiroi* (H. Christ & Rosenst.) A. R. Sm. & R. C. Moran and *M. flabelliformis* (Poir.) A. R. Sm. & R. C. Moran, because of its glabrous rachis and long-creeping rhizomes.

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